2015-santiago-AIAA Review-TN25940

Unmanned aircraft will equip with a detect-and-avoid (DAA) system that enables them to comply with the requirement to "see and avoid" other aircraft, an important layer in the overall set of procedural, strategic and tactical separation methods designed to prevent mid-air collisions. This paper describes a capability called Java Architecture for Detect and Avoid Extensibility and Modeling (JADEM), developed to prototype and help evaluate various DAA technological requirements by providing a flexible and extensible software platform that models all major detect-and-avoid functions. Figure 1 illustrates JADEM's architecture. The surveillance module can be actual equipment on the unmanned aircraft or simulators that model the process by which sensors on-board detect other aircraft and provide track data to the traffic display. The track evaluation function evaluates each detected aircraft and decides whether to provide an alert to the pilot and its severity. Guidance is a combination of intruder track information, alerting, and avoidance/advisory algorithms behind the tools shown on the traffic display to aid the pilot in determining a maneuver to avoid a loss of well clear. All these functions are designed with a common interface and configurable implementation, which is critical in exploring DAA requirements. To date, JADEM has been utilized in three computer simulations of the National Airspace System, three pilot-in-the-loop experiments using a total of 37 professional UAS pilots, and two flight tests using NASA's Predator-B unmanned aircraft, named Ikhana. The data collected has directly informed the quantitative separation standard for "well clear", safety case, requirements development, and the operational environment for the DAA minimum operational performance standards. This work was performed by the Separation Assurance/Sense and Avoid Interoperability team under NASA's UAS Integration in the NAS project.